Edwards

INSTRUCTION
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EXTERNAL OIL FILTRATION SYSTEM (EOF)

MP MASTER
MA32940

SUPPLIED BY
PLASMA TECHNOLOGY

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COMMUNICATION WITH EDWARDS

1. INTRODUCTION

The Edwards external oil filtration (EOF) system is designed to extend the life of the vacuum pump and its lubricating fluid by removing contaminant materials. These are process dependent and can take the form of particulates and chemical contaminants such as acids and solvents.

The EOF system is supplied in modular form. The complete system comprises the base assembly, canister assembly, filter element and connexion kit.

This manual contains all information that is needed to install, start, operate and maintain the external oil filtration system.

IMPORTANT

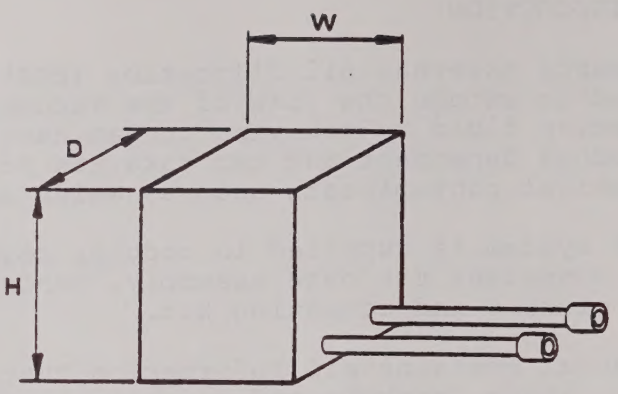
WARNING Statements are used to identify potential hazard conditions and describe safe procedures which will prevent personnel injury.

CAUTION Statements are used to identify conditions which risk damaging the equipment.

2. SPECIFICATIONS

2.1 Dimensions

Height (mm) 435
Depth (mm) 320
Width (mm) 385
Hoses (mm) 1000 long
Disconnects 3/8 in



Charge volumes

Canister size	25CR	40CR	80CR/HC
Canister (l)	2.30	3.40	6.80
Base (l)	0.20	0.20	0.20
System (l)	2.50	3.60	7.00

Weights (dry)

Base (HC and CR) 22.5kg
Canisters (HC and CR)

25 : 2.8 kg
40 : 4.0 kg
80 : 7.6 kg

n.b. Density of mineral oils 0.9 kg/1
PFPE oils 1.9 kg/1

2.2 Component materials

		HC	CR
Pump:	Rotating parts	Hardened steel	Hardened steel
	Static parts	Cast iron	Cast iron
	Mechanical seal	Carbon/Ceramic/ Nitrile	Carbon/Ceramic/ Fluoroelastomer
Pipe and fittings		Steel	Stainless steel
Self seal disconnects		Bronze/Nitrile	Stainless steel/ Fluoroelastomer
Flow block		Cast iron	Cast iron
Flexible hose		PTFE/Astatic/ SS braid	PTFE/Astatic/ SS braid
Canister		Aluminium	Aluminium
O-rings		Nitrile	Fluoroelastomer
Adapter kits		Stainless steel/ Fluoroelastomer	Stainless steel/ Fluoroelastomer

2.3 Pump performance

Flow rate	3.5 l/m (50Hz) : 4.2 lm (60Hz)
Relief pressure	60 psi
Speed	4 pole 1450 rpm @ 50Hz 1740 rpm @ 60Hz

2.4 Motor data

Insulation class	F
Power (W)	200
Speed (rpm)	1450/1740
Volts	100-120/200-240
Phase	Single
Frequency (Hz)	50/60
Current (A)	5.0/2.5
Enclosure	IP44

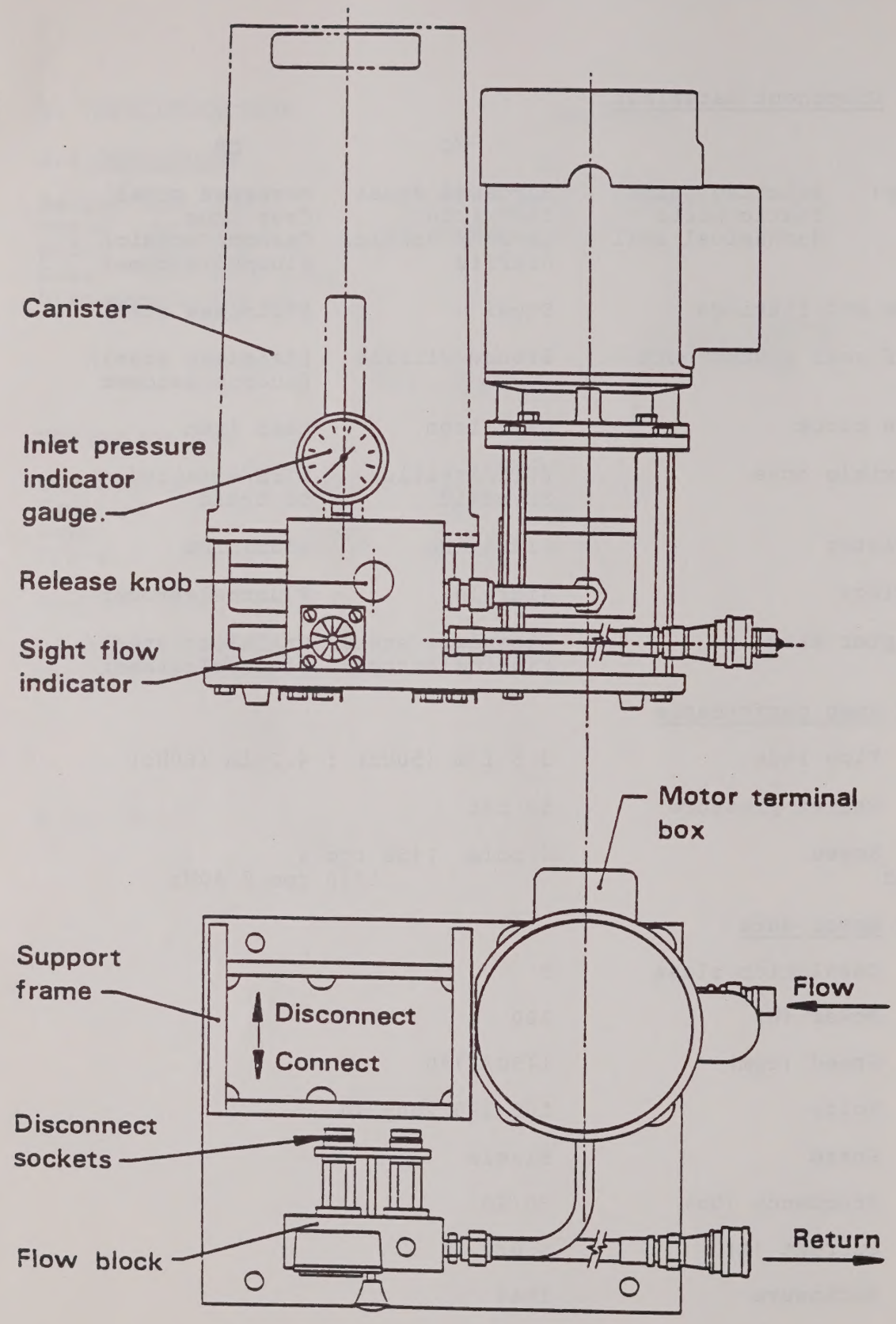


Fig 1 Edwards EOF External Oil Filtration System

3. GENERAL DESCRIPTION

3.1 System Modules

The EOF system is supplied in modular form. A system comprises modules 1-3 as follows and an adapter kit is required to connect to the vacuum pump.

Module 1	Base Assembly	)
Module 2	Canister Assembly	) EOF System
Module 3	Filter Elements	)
Module 4	Adapter kit	

3.2 Specification Levels

There are two levels of specification available

HC (Hydrocarbon)
This is intended for use on applications where the contaminant load is particulate and has little or no chemical component.
n.b. HC equipment is not prepared for use with PFPE fluids.

CR (Corrosion Resistant)
This is intended for use on applications with a combination of chemical and particulate contaminant loads. CR speciiication equipment is cleaned to remove all hydrocarbons and is suitable for use with PFPE fluids.

WARNING Before using the EOF system, check that the specification level of the equipment is compatible with the chemical contaminants produced in the application.

WARNING The selection level must be based on the resistance of the materials of construction of the EOF system (See Section 2.2) to corrosive attack from the chemical contaminants in the oil. Failure to ensure compatibility could result in leaks of toxic and/or volatile materials. If in doubt consult EHVI.

WARNING Hydrocarbon (HC) equipment is not suitable for applications pumping oxygen in concentrations above normal atmospheric.

3.3 System Schematic Arrangement

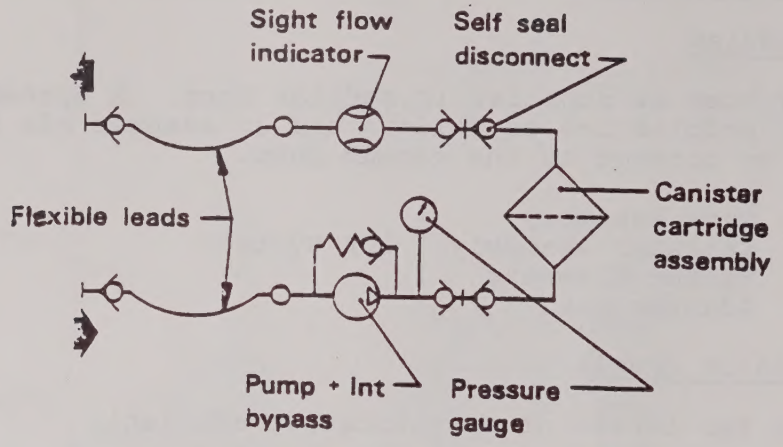


Fig 2 System schematic arrangement

3.4 Base Assembly

This consists of a pump and motor, a flow block with a pressure gauge and sight flow indicator all mounted on a base tray. At the back of the flow block are two fixed female disconnects - the mating halves are attached to the canister. The Base also includes a pair of one metre flexible hoses and two pairs of pump end disconnects.

3.4.1 Pump

The EOF has a shaft sealed gear pump with integral pressure relief valve (See Section 2.3). The relief valve protects the system from overpressure to reduce the risks of bursting hazards.

3.4.2 Motor

The motor is a single phase dual voltage, dual frequency unit suitable for a wide range of supply options (See Section 2.3).

3.4.3 Pressure Gauge

The gauge monitors back pressure upstream of the filter element. Back pressure is the key indicator of element condition and the gauge is colour coded to show the need for element replacement as described in Section 5. A pressure switch is available as an optional extra (See Section 3.8.1)

3.4.4 Self-Seal Disconnects

To promote clean and convenient filter replacement the canister is connected to the base by a pair of self-seal disconnects operated by a simple pull rod (as described in Section 5). The provision of a spare canister eliminates down time and enables element replacement to be carried out when and where convenient.

3.4.5 Sight Flow Indicator

The polypropylene wheel provides a positive indication of flow and visual access to the lubricant stream on the outlet side of the filter enabling a qualitative assessment of oil condition.

3.5 Canister Assembly

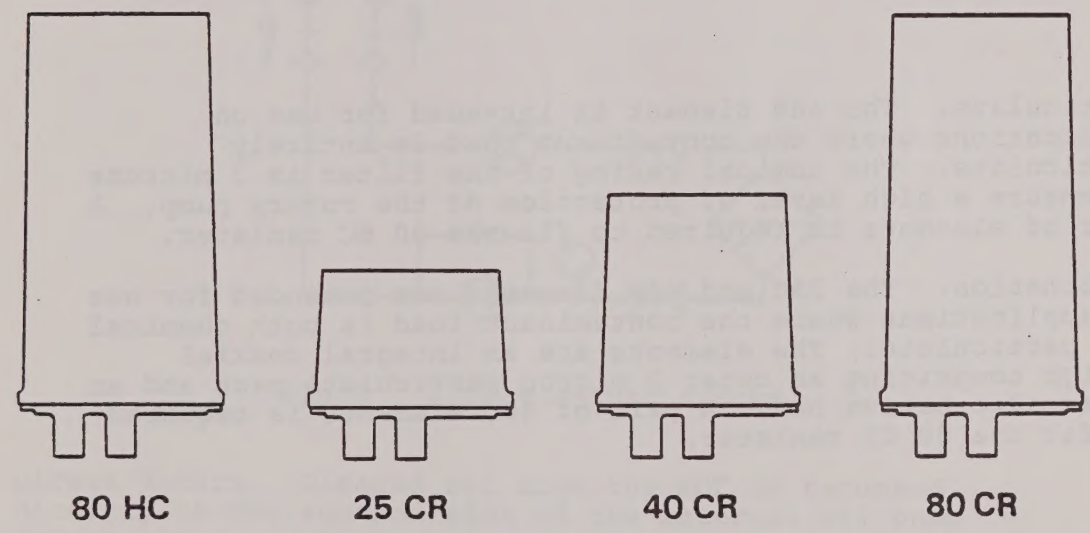


Fig 3 A choice of four canister selections is available

CR Canisters are available in three sizes (25, 40 and 80) to allow the volume charge/filtration capacity ratio to be matched to the weight of contaminant load to ensure economical usage of expensive PFPE fluids.

HC Canisters are standardised on the 80 size unit.

3.6 Filter Element

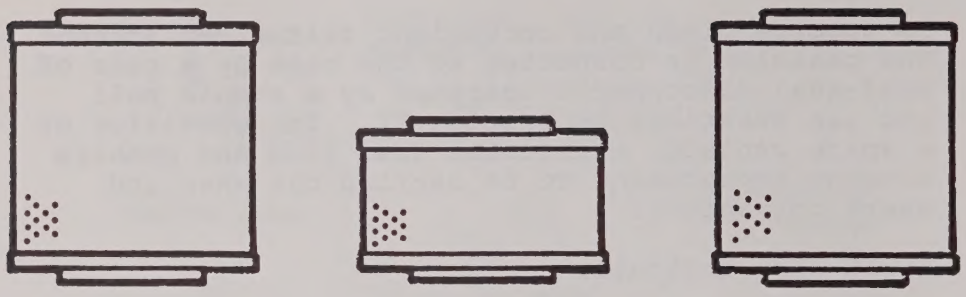


Fig 4 A choice of three filter elements is available

Particulate. The 40P Element is intended for use on applications where the contaminant load is entirely particulate. The nominal rating of the filter is 3 microns to ensure a high level of protection of the rotary pump. A pair of elements is required to fit the 80 HC canister.

Combination. The 25C and 40C Elements are intended for use on applications where the contaminant load is both chemical and particulate. The elements are an integral coaxial design comprising an outer 3 micron particulate pack and an inner adsorbative bed. A pair of 40C elements is required to fit the 80 CR canister.

3.7 Connexion to Vacuum Pump

The EOF System is designed for use on the Edwards range of rotary pump M18 to M275.

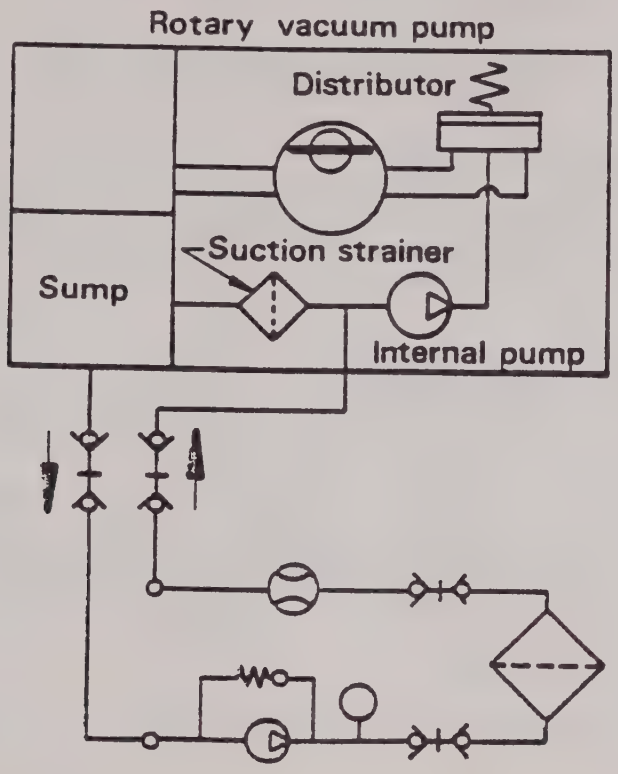


Fig 5 Direct return system

Direct Return. Cleaned oil from the EOF is returned directly to the suction side of the internal oil pump downstream from the suction strainer.

Full Flow. On all pumps up to and including the M80 pumps the flow in the EOF exceeds the internal flow so that 100% cleaned oil is used to lubricate the vacuum pump and the balance back flushes the Suction Strainer.

Adapter Kits. A series of kits as detailed in Section 7 is available to provide the fittings necessary to connect the EOF to the vacuum pump.

3.8. Accessories

3.8.1. Pressure Switch

To provide contacts which switch on rising back pressure to enable an indication of element exhaustion.

3.8.2. Flow Switch

To provide contacts which switch on low flow to enable an indication of pump failure, by-pass or blockage.

3.8.3. Sampling Valve

Provides a facility for obtaining oil samples for acidity testing and analysis.

3.8.4. Outlet Pressure Gauge

Indicates pressure at the canister outlet so that in conjunction with the Inlet gauge the pressure differential across the filter can be measured.

4. INSTALLATION AND COMMISSIONING

4.1 Installation

The EOF System is free standing and should be mounted on a flat,level surface. It utilises a space 380 mm (W) x 300 mm (D) x 435 mm (H) with access for lifting the canister for element renewal. Attach the canister as outlined in section 5.4.

4.2 Connexion to rotary pump

An adapter kit is required to fit the necessary connexions to the vacuum pump.

All current production Edwards rotary pumps in the range M18to M275 are suitable for direct return connexion using the kits listed in section 7.

For earlier models with serial numbers prior to those listed below, please consult Edwards High Vacuum International

Pumps	Serial number
E1M18*	1241
E2M18*	5518
E2M40*	720
E2M40*	3168
E1M80*	463
E2M80*	1926
E2M40S (Superpump)	Pumps built after November 1986
E2M80S (Superpump)	Pumps built after November 1986
E1M175	Pumps built after November 1986
E2M175	Pumps built after November 1986
E2M175F	All Fomblin pumps are suitable for direct return connexion

Pump	Serial number
E1M275	Pumps built after November 1986
E2M275	Pumps built after November 1986
E2M275F	All Fomblin pumps are suitable for direct return connexion

* Retrofit pumps marked thus are arranged for oil box circulation rather than direct return.

CAUTION It is essential that the pump end disconnects are correctly handed as shown in the adapter kit instructions. Reverse connexion will negate the filtration performance and starve the vacuum pump of lubricant.

4.3. Electrical connexion

WARNING Electrical wiring connexions should be undertaken only by suitably experienced and qualified personnel.

4.3.1. Cable

The EOF System has a single phase motor and requires 3 core wiring connexion to the motor terminal box to suit the following current ratings:

100-120V	5.6A
200-240V	2.8A

4.3.2. Switching

An in line switch must be provided in the line cable adjacent to the EOF filtration system.

CAUTION If the EOF system is not provided with an independently switched supply this may create a hazard when changing filtration elements.

4.3.3. Motor connexion

WARNING 1. It is essential for electrical safety that a ground wire supply is connected to the earthing terminal in the motor terminal box.

WARNING 2. A fuse unit or circuit breaker must be incorporated in the electrical supply line.

WARNING 3. All wiring to the electrical supply must be undertaken by experienced and competent personnel.

The terminal box wiring should be made in accordance to the instructions on the inside of the terminal box cover. This must be for reversed rotation. Once all electrical connexions have been made momentarily switch on and check for correct direction of rotation. The motor fan should rotate clockwise.

4.4 Fitting element to canister

4.4.1. When commissioning the EOF system for the first time it will be necessary to fit an element into the canister. First release the canister by pulling the release knob and drawing the canister away from the disconnect sockets (fig 6).

4.4.2. Using a 13mm AF spanner remove the four M8 nuts and plain washers securing the lid assembly to the canister body.

4.4.3. It will be necessary to insert a wide blade screwdriver alternately in the two slots cast into the edge of the large joint and carefully ease off the lid (fig 8).

4.4.4. Unpack the filter and using the wire loop handle lower the new element into position. Check that the element is centrally located.

4.4.5. Replace the lid assembly and secure with the four M8 nuts and plain washers, tightening in a diagonal and progressive manner.

4.4.6. Hold the canister with the lid end down (flat end uppermost) and lower onto the support frame.

4.4.7 Draw the canister horizontally forwards towards the flow block unit it engages in the disconnect sockets. This is indicated by the release knob clicking forward.

4.4.8. Prime the system as described in section 4.5.

4.5 Priming

4.5.1. Priming is a two stage process. First stop the vacuum pump. A supply of sufficient clean compatible oil to fill the EOF system should be obtained as follows:

25 system	2.5 litres
40 system	3.6 litres
80 system	7.0 litres

4.5.2. Top up the oil in the vacuum pump to the maximum level as indicated on the sight glass.

4.5.3. Start the EOF system and check that the oil level in the vacuum pump lowers indicating that the pump is priming.

CAUTION Do not allow the EOF pump to run for longer than 1 minute if there is no evidence of priming.

4.5.4. Continually top up the vacuum pump oil level to match the rate of prime of the EOF system.

4.5.5. If the EOF system fails to prime re-check operations 4.4.2, 4.3.3. and 4.4.7. Rectify any faults found. If all is in order it may be necessary to wet the internal components of the EOF pump.

4.5.6. To wet the EOF pump internal components disconnect the hoses from the vacuum pump and unscrew the self-seal disconnects. Note which hoses they are connected to as they are handed. Place both hose ends in a clean container of compatible oil (no less than 0.5 litre) and switch on the EOF system. Bubbles should emerge from the return hose and wetting volume be rapidly drawn in. Replace the disconnects and reconnect the EOF system to the vacuum pump.

4.5.7. Switch on as outlined in operation 4.5.3.

4.5. Start-up checks

4.5.1. Flow

Ensure that the sight flow wheel is turning indicating flow. Initially trapped gas bubbles may appear but these should clear within 2-3 minutes. Failure to do so indicates a leak on the suction side of the EOF pump.

4.5.2 Pressure

The reading on the inlet pressure gauge will be approximately 30 on start-up with the oil at 20°C. This indication will drop to less than 20 as the oil temperature rises.

NB: Dirty oil in the vacuum pump may require the first element change to be made earlier than for subsequent changes.

5. OPERATION

5.1. Element exhaustion

The back pressure indicated on the inlet pressure gauge will vary with oil temperature and element condition.

The condition of the element should only be assessed when the oil being pumped through the EOF system is warm ($35^{o}C$) - when the canister feels warm to touch. In this condition a back pressure greater than 50 indicates the filtration capacity of the element is exhausted.

5.2. Canister removal

WARNING 1. Before disconnecting the canister switch off the EOF filtration system.

WARNING 2. Gloves should be used when handling the canister.

WARNING 3. When the canister is disconnected a small amount of oil will drip from the self seal couplings on the base module and on the canister. If the oil contains any aggressive contaminants the operator must take all precautions appropriate to the hazard.

The canister is disconnected from the EOF system by pulling the release knob. This will allow the canister to slide back on the support frame. It can then be lifted away for service (fig 6).

5.3 Element renewal

WARNING 1. If the EOF system has been used on an application generating toxic, volatile, corrosive or in any other way hazardous contaminants proper safety precautions appropriate to the level of hazard should be taken during the element renewal procedure.

WARNING 2. On hazardous duties Edwards recommends the use of gloves, apron and safety glasses under a fume food as a minimum. For toxic hazards breathing apparatus should be used.

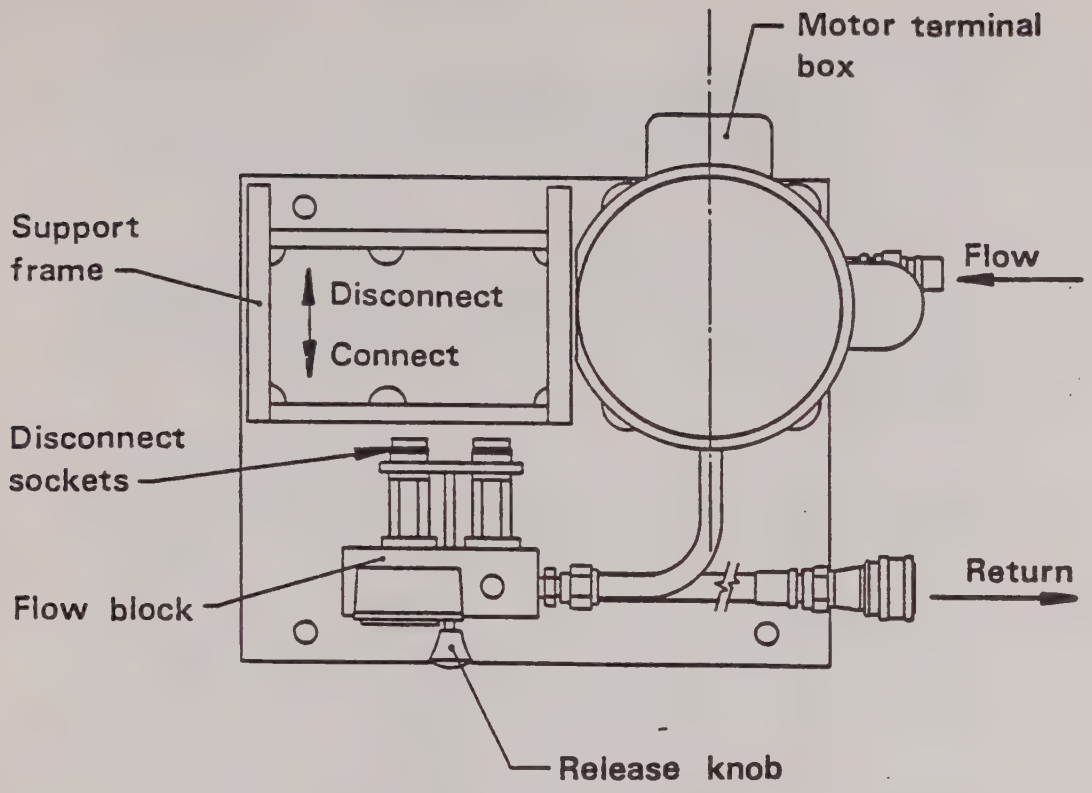


Fig 6 Canister connexions

5.3.1. Stand the canister on its flat base with the disconnect fittings uppermost. The provision of absorbent tissue and a drip tray will assist in carrying out the sequence cleanly. The lid assembly will drip oil on removal. A receptacle for waste oil will also be required.

5.3.2. Release pressure within the canister by depressing one of the hose disconnects internal valve slides.

5.3.3. Using a 13 mm A/F spanner remove the four M8 nuts and plain washers securing the lid assembly to the canister body.

5.3.4. It will be necessary to insert a wide blade screwdriver alternately in the two slots cast into the edge of the flange joint and carefully ease off the lid (fig 8).

5.3.5. Using the wire loop handle carefully withdraw the waste element from the canister.

5.3.6. Pour off the residue of contaminated oil from the canister.

5.3.7. If the internal surfaces of the canister or lid are covered with deposit they should be wiped clean. Particular care should be taken to ensure that the sealing surfaces of the spring seal plate on the lid assembly and internal element gasket seats are clean ensuring a good seal on re-assembly.

5.3.8. Insert a new Edwards approved element (see section 7) into the canister with the handle upwards (at the open end). Check that the element is centrally located.

5.3.9. Fill the canister with oil until the level is flush with the top of the element. Allow five minutes for the element to partially absorb oil and top up to the top of the element.

5.3.10. Inspect the lid piston seal O-ring for damage and renew if necessary. A new O-ring should be lubricated with a compatible grease.

5.3.11. Replace the lid assembly and secure with the four M8 nuts and plain washers, tightening in a diagonal and progressive manner.

5.4 Canister re-connexion

5.4.1. Hold the canister with the lid end down/flat end uppermost and lower onto the support frame.

5.4.2. Draw the canister horizontally forward towards the flow block until it engages in the disconnect sockets. this is indicated by the release knob clicking forward (fig 6).

6. MAINTENANCE

The EOF filtration system is exposed to all the abrasive particulate and corrosive chemical contaminants from which it protects the vacuum pump. This exposure may result in a gradual degradation of some of the EOF system components depending on the severity of contamination. These can be renewed where necessary.

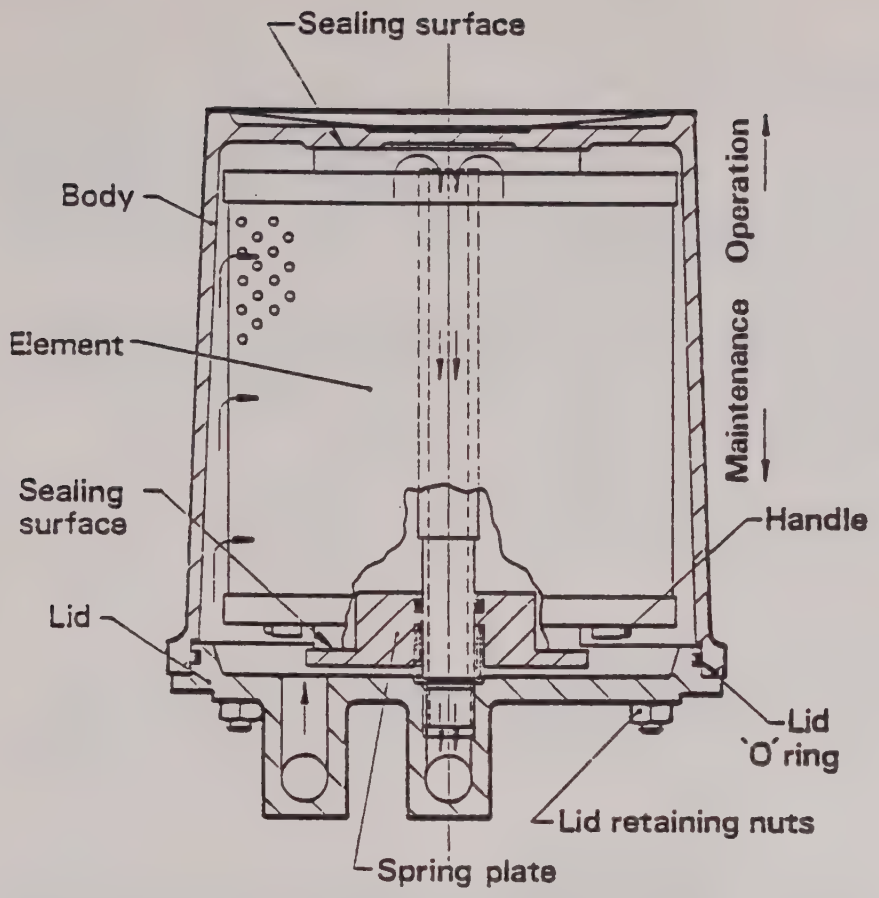


Fig 7 Cross sectional view of canister and element

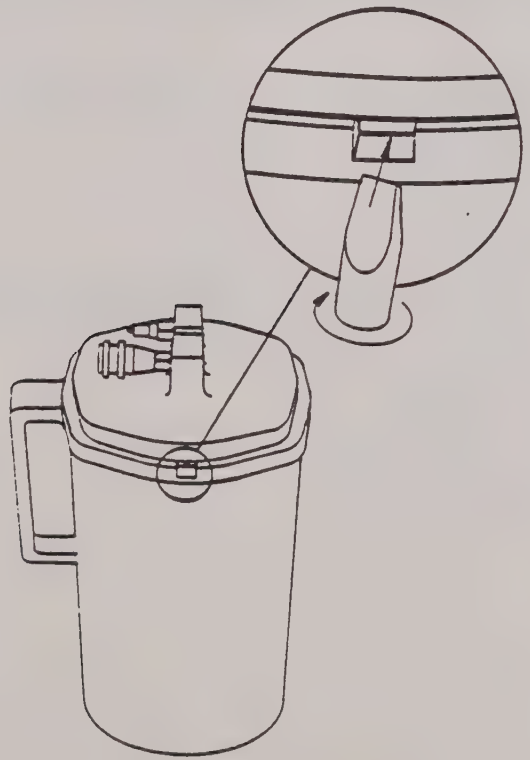


Fig 8 Using screwdriver to ease lid from canister body

6.1. Pumps - HC and CR

There are several fault conditions such as seal leakage and pressure relief valve malfunction but the most likely pump problem is reduced output due to gear wear. This will be evident by the rotation of the sight flow indicator wheel slowing and eventually stopping.

A flow switch (see Accessories 3.7 and Ordering Information 7) is available to provide a switched output on reduced flow rate (less than 2 l/m) which can be arranged to operate an audible and/or visible alarm. This is the recommended method of low flow detection.

In the event of any pump malfunction the pump unit should be replaced with an Edwards unit of equivalent specification.

6.2. Motor

The motor is of robust construction and should provide years of trouble-free service. However if any defects develop it should be replaced with the equivalent Edwards unit.

6.3. Miscellaneous items

WARNING Leaks may present a toxic or corrosive hazard. Leaking components should be replaced immediately and safety precautions appropriate to the hazard must be taken during the replacement procedure.

Various consumable maintenance items are available as spares (See Section 7).

7. ORDERING INFORMATION

Description	Ordering Number
Base modules	
PFPE prepared CR base module with inlet pressure gauge, flow indicator, face seal gear pump, canister support base, tray, S.S. hoses and two pairs S.S. disconnects.	A540-11-999

Hydrocarbon prepared HC base module with inlet pressure gauge, flow indicator, face seal gear pump, canister support base, tray, S.S. hoses and two pairs M.S. disconnects.	A540-01-999

CAUTION The HC base should NOT be used with oxygen. Only use oxygen compatible fluids such as PFPE.

EOF canisters:

80 HC	A540-08-022
25 CR	A540-12-022
40 CR	A540-14-022
80 CR	A540-18-022

Spare elements:

40 P	A223-04-068
40 C	A223-04-072
25 C	A223-04-070

Accessories:

Flow switch	A504-10-000
Pressure switch	A504-11-000
Oil sampling valve	A504-09-000
Canister outlet pressure gauge	H019-00-013

Adapter kits*

E1M18, E2M18, E2M28, E2M30	A540-00-001
E1M40, E2M40	A540-00-002
E1M80, E2M80	A540-00-004
E1M175, E2M175, E1M275, E2M275	A540-00-006

* Refer Section 4.2 for pump serial numbers.

NOTE: Contact Edwards High Vacuum International for advice on fitting the EOF filtration system to Edwards pumps not covered by the above.

Spare parts

	HC	CR
Pump	A260-01-010	A260-01-011
Motor	A071-07-019	
Manifold disconnect sockets (2)	A540-01-050	A540-11-050
Canister disconnect nipples (2)	A540-01-054	A540-11-054
Hose end disconnects (2 pairs)	A540-01-051	A540-11-051
Flexible hoses	A540-01-052	
Canister seals kit	A540-01-820	A540-11-820
Flow indicator kit	A540-01-053	
Pressure gauge	H019-00-015	H019-00-016

COMMUNICATION WITH EDWARDS

Any communication relating to the subject of this instruction should be addressed to Edwards High Vacuum International or to the supplier from whom it was purchased.

Please specify:

1) the model, serial number and code.

2) the date of purchase.

3) your order number and the suppliers sales reference.

Equipment MUST NOT be returned to the supplier without prior arrangement.

IMPORTANT Health and Safety

Under Section 3 of the Health and Safety at Work Etc. Act. 1974 every employer has a duty to conduct his business so as not to expose persons not in his employment to risks to their health and safety. When goods are returned to the supplier, therefore, warning must be given if their usage is likely to render the equipment hazardous in any way. Your attention is drawn to FORM HSC001 attached.

Edwards High Vacuum International and its distributors reserve the right to refuse acceptance of any equipment which they have reason to believe may be hazardous.

Damage in transit

If any damage has occurred in transit, it is important to inform both the carrier and the supplier within three days of delivery.

Edwards SERVICE
(Part of The BOC Group plc)
W. Sussex RH10 2LW
Tel: 0293 28844
Telex: 87123 edlvac g

HEALTH AND SAFETY CLEARANCE
FORM HSC 001

1.0 This form must be used when returning pumps and equipment for service at EHV or EHV distributor as per EHV procedure.

2.0 A completed copy of this form should be Faxed *(Fax No. 0293 33453)* or sent by 1st class post to ensure that we have this information before we receive the equipment.

A further copy should be handed to the carrier with the equipment.

3.0 Failure to complete the form or comply with the procedure will lead to delays in servicing the equipment.

4.0 Please complete the following sections:

4.1 Pump/Equipment Type .....

4.2 Serial No. .....

4.3 Details of all substances pumped.

4.3.1 Chemical names:

(a) .....

(b) .....

(c) .....

(d) .....

4.3.2 Precautions to be taken in handling of these substances:

(a) .....

(b) .....

(c) .....

(d) .....

4.3.3 Action to be taken in the event of human contact or spillage:

(a) .....

(b) .....

(c) .....

(d) .....

4.4 Any further information which you consider relevant

4.5 Please complete section 4.5.1 if substances are not toxic or hazardous or 4.5.2 if they are.

4.5.1 I hereby confirm that the equipment specified above has **not** pumped or come into contact with any toxic or hazardous substances and that the equipment has been drained of lubricant.

Signed: .....

Name: .....

Position .....

For and on behalf of: .....

Date .....

4.5.2 I hereby confirm that the only toxic or hazardous substances that the equipment specified above has pumped or been in contact with are named above, that the information given is correct and that the following actions have been taken:

1. The equipment has been drained of lubricant.
2. The inlet/outlet ports have been sealed and the equipment has been securely packed and labelled in accordance with EHV procedure.
3. The carrier has been informed of the hazardous nature of the consignment.

Signed: .....

Name: .....

Position: .....

For and on behalf of: .....

Date: .....

4.6 Carrier to be used: .....

Delivery date to EHV: .....

MP MASTER
MA32940

IMPORTANT

Before returning any product for service this form must be completed and sent to the Edwards company or official distributor undertaking the service.